PATENT
Attorney Docket No. 401242

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

OKUI et al.

Application No.:	Unassigned	Art Unit:	Unassigned
Filed:	June 8, 2001	Examiner:	Unassigned
For:	IMAGE SENSOR		

PRELIMINARY AMENDMENT

09875171 . 060801

Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

Prior to the examination of the above-identified patent application, please enter the following amendments and consider the following remarks.

IN THE SPECIFICATION

Replace the paragraph beginning at page 1, line 5, with:

The present invention relates to an image sensor, and more particularly to an image sensor producing an output image superior in uniformity by correcting variations in the characteristics of solid state photosensing devices.

Replace the paragraph beginning at page 1, line 11, with:

An image sensor picks up an image of an object with an array of solid state photosensing devices which are arranged two-dimensionally. Each of the solid state photosensing devices receives light from an object and converts the light into respective electric signals. A weak signal produced is amplified in an amplifier circuit. The solid

state photosensing devices have some variations in characteristics, and thus the output signal is not constant even though uniform light is incident on each of the solid state photosensing devices. Amplification of the output signal as it is yields an image which suffers from the non-uniformity of the output signal. Therefore, the variations in the characteristics of the solid state photosensing devices need to be corrected in the signal amplifier circuit.

Replace paragraph beginning at page 3, line 5, with:

The output current is converted into a voltage signal in the current-voltage conversion circuit 10, and stored as a stored signal in the analogue memory for stored signals 11 of the differential circuit 14. A selection signal is then fed to the reset selection terminal 5 to reset the photodiode 4 to the potential of the reset terminal 7. Feeding a selection signal to the output selection terminal 6 supplies the output terminal 8 with an output current corresponding to the reset state, in other words, a state where the incidence of light is substantially zero. The output current is converted to a voltage signal in the current-voltage conversion circuit 10, and stored in the analogue memory for reset signals 12 as a reset signal. The differential circuit 14 produces an output of a difference between the stored signal and the reset signal from the differential amplifier 13. The output of the differential circuit 14 is fed to the gain variable amplifier 64 to be amplified.

Replace the paragraph beginning at page 4, line 9, with:

While the reset levels, namely, the outputs of the solid state photosensing devices 3 produced in a state in which the quantity of light incident on the photodiode 4 is substantially zero, differ from one solid state photosensing device to another as shown by the numeral 70 of FIG.15A, the reset levels are in agreement with each other in the outputs of the gain variable amplifier 64 as shown by the numeral 87. However, the gains and the saturation levels, as shown by the numerals 88 and 89, differ from one solid state photosensing device to another.

Replace the paragraph beginning at page 4, line 18, with:

As a method for correcting variations in the characteristics of the solid state photosensing device, Japanese Patent Laid-Open No. Sho. 56-161777, for example, discloses a method of storing the output signals of each solid state photosensing device for the two levels of reference signals of light (a black level and a white level) and correcting variations of each picture element in sensitivity by using the stored output signals. It should be noted that this method requires supplying two levels of reference signals of light and the saturation levels differ from one solid state photosensing device to another even though the correction is performed.

PATENT 450100-2960

IN THE CLAIMS

Replace the indicated claims with:

1. (Amended) An image sensor comprising:

an image sensing portion having a plurality of solid state photosensing devices for converting light into electric signals,

drive potential supply means for supplying a drive potential to the solid state photosensing devices,

amplifying means for receiving the electric signals and amplifying the electric signals with a variable gain, and

controlling means for controlling the variable gain of the amplifying means, wherein the amplifying means changes the variable gain according to a reset signal produced by the solid state photosensing device in a state in which substantially no light is incident.

2. (Amended) The image sensor as set forth in Claim 1, wherein the drive potential supply means supplies two switchable levels of drive potentials and the amplifying means changes the variable gain according to two different reset signals which

are produced by the solid state photosensing devices in response to the two switchable levels of drive potentials.

3 (Amended) The image sensor as set forth in Claim 1, wherein the amplifying means has a linear input-output relation.

4. (Amended) The image sensor as set forth in Claim 2, wherein the amplifying means has a non-linear input-output relation.

5. (Amended) The image sensor as set forth in Claim 1, wherein the amplifying means produces the electric signal in digital format.

6. (Amended) The image sensor as set forth in Claim 1, further comprising storing means for storing reset signals produced by each of the solid state photosensing devices, wherein the amplifying means changes the variable gain according to the stored reset signals.

7. (Amended) The image sensor as set forth in Claim 1, wherein the solid state photosensing devices produce the electric signals in a non-linear relation with respect to quantity of incident light.

IN THE ABSTRACT

Replace the abstract with:

ABSTRACT OF THE DISCLOSURE

An image sensor producing an output image superior in uniformity by correcting variations in the characteristics of solid state photosensing devices (pixels) . Correction utilizes a correlation between a reset signal and sensitivity of the solid state photosensing devices. A reset signal is produced by driving the solid state photosensing devices in a

state in which substantially no light is incident. The solid state photosensing devices convert light into an electric output signal and a gain variable amplifier circuit amplifies the signal with a gain based on the reset signal. Saturation levels of the solid state photosensing devices, gains in the vicinity of the reset level, or both of them are corrected. This process removes the necessity of supplying a reference light signal in the image sensor.

09875171.060801

REMARKS

The foregoing amendments are made to correct minor translational errors and to meet United States requirements as to form. No new matter is added.

Respectfully submitted,

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PTO/SB/21 (09-04)

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SPECIFICATION, CLAIMS AND ABSTRACT AS PRELIMINARILY AMENDED

09876147.060801

Amendments to the paragraph beginning at page 1, line 5:

The present invention relates to an image sensor, and more particularly to an image sensor ~~which is capable of~~ producing an output image superior in uniformity by correcting ~~the~~ variations in the characteristics of solid state photosensing devices.

Amendments to the paragraph beginning at page 1, line 11:

An image sensor picks up an image of an object with an array of solid state photosensing devices which are arranged two-dimensionally. ~~While each~~Each of the solid state photosensing devices receives light from an object ~~to convert it~~ and converts the light into ~~an~~ respective electric ~~signal, the~~ signals. A weak signal produced is amplified in an amplifier circuit. The solid state photosensing devices have some variations in ~~the~~ characteristics, and thus the output signal is not constant even though uniform light is incident on each of the solid state photosensing devices. Amplification of the output signal as it is yields an image which suffers from the non-uniformity of the output signal. Therefore, the variations in the characteristics ~~among~~ of the solid state photosensing devices ~~are in~~ need to be corrected in the signal amplifier circuit.

Amendments to the paragraph beginning at page 3, line 5:

The output current is converted into a voltage signal in the current-voltage conversion circuit 10, and stored as a stored signal in the analogue memory for stored signals 11 of the differential circuit 14. A selection signal is then fed to the reset selection terminal 5 to reset the photodiode 4 to the potential of the reset terminal 7. Feeding a selection signal to the output selection terminal 6 supplies the output terminal 8 with an output current corresponding to the reset state, in other words, a state where the incidence of light is substantially zero. The output current is converted to a voltage signal in the current-voltage conversion circuit 10, and stored in the analogue memory for reset signals 12 as a reset signal. The differential circuit 14 produces an output of a ~~differential~~ difference between the stored signal and the reset signal ~~by~~ from the differential amplifier 13. The output of the differential circuit 14 is fed to the gain variable amplifier 64 to be amplified.

Amendments to the paragraph beginning at page 4, line 9:

While the reset levels, namely, the outputs of the solid state photosensing devices 3 produced in a state in which the quantity of light incident on the photodiode 4 is substantially zero, differ ~~in height~~ from one solid state photosensing device to another as shown by the numeral 70 of FIG.15A, the reset levels are in agreement with each other in the outputs of the gain variable amplifier 64 as shown by the numeral 87. However, the gains and the saturation levels, as shown by the numerals 88 and 89, differ from one solid state photosensing device to another.

Amendments to the paragraph beginning at page 4, line 18:

As a method for correcting variations in the characteristics of the solid state photosensing device, Japanese Patent Laid-Open No. ~~161777(1981)~~ Sho. 56-161777, for example, discloses a method of storing the output signals of each solid state photosensing device for the two levels of reference signals of light (a black level and a white level) and

correcting variations of each picture element in sensitivity by using the stored output signals. It should be noted that this method requires supplying two levels of reference signals of light and the saturation levels differ ~~in height~~ from one solid state photosensing device ~~from~~ to another even though the correction is performed.

Amendments to the existing claims:

1. (Amended) An image sensor comprising:

an image sensing portion having a plurality of solid state photosensing devices for converting light into ~~an~~ electric ~~signal~~ signals,

drive potential supply means for supplying a drive potential ~~of~~ to the solid state photosensing devices,

amplifying means for receiving the electric ~~signal~~ signals and amplifying the electric ~~signal~~ signals with a variable gain, and

controlling means for controlling the variable gain of the amplifying means, wherein the amplifying means changes the variable gain according to a reset signal produced by the solid state photosensing device in a state in which substantially no light is ~~substantially~~ incident.

2. (Amended) ~~An~~The image sensor as set forth in Claim 1, wherein the drive potential supply means supplies two switchable levels of drive potentials and the amplifying means changes the variable gain according to two different reset signals which are produced by the solid state photosensing devices ~~on driving at~~ in response to the two switchable levels of drive potentials.

3 (Amended) ~~An~~The image sensor as set forth in Claim 1, wherein the amplifying means has a linear input-output relation.

4. (Amended) ~~An~~The image sensor as set forth in Claim 2, wherein the amplifying means has a non-linear input-output relation.

5. (Amended) ~~An~~The image sensor as set forth in Claim 1, wherein the amplifying means produces ~~an output of~~ the electric signal in digital format.

6. (Amended) ~~An~~The image sensor as set forth in ~~Claims~~ Claim 1, further comprising storing means for storing ~~a~~ reset ~~signal~~ signals produced by each of the solid state photosensing devices, wherein the amplifying means changes the variable gain according to the stored reset ~~signal~~ signals.

7. (Amended) ~~An~~The image sensor as set forth in Claim 1, wherein the solid state photosensing devices produce ~~an output of~~ the electric ~~signal~~ signals in ~~the~~ a non-linear relation with respect to ~~the~~ quantity of incident light.

Amendments to the abstract:

ABSTRACT OF THE DISCLOSURE

An image sensor ~~which is capable of~~ producing an output image superior in uniformity by correcting variations in the characteristics of solid state photosensing devices (pixels) . Correction utilizes a correlation between a reset signal and sensitivity of the solid state photosensing devices~~, where the~~. A reset signal is produced by driving the solid state photosensing devices in a state in which substantially no light is ~~substantially~~ incident. The solid state photosensing devices convert light into an electric output signal and a gain variable amplifier circuit amplifies the signal with a gain based on the reset signal. Saturation levels of the solid state photosensing devices, gains in the vicinity of the reset level, or both of them are corrected. This process removes the necessity ~~to supply~~ of supplying a reference ~~signal of~~ light signal in the image sensor.

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CLAIMS PENDING AFTER PRELIMINARY AMENDMENT

09576704.060601

1. An image sensor comprising:

an image sensing portion having a plurality of solid state photosensing devices for converting light into electric signals,

drive potential supply means for supplying a drive potential to the solid state photosensing devices,

amplifying means for receiving the electric signals and amplifying the electric signals with a variable gain, and

controlling means for controlling the variable gain of the amplifying means, wherein the amplifying means changes the variable gain according to a reset signal produced by the solid state photosensing device in a state in which substantially no light is incident.

2. The image sensor as set forth in Claim 1, wherein the drive potential supply means supplies two switchable levels of drive potentials and the amplifying means changes the variable gain according to two different reset signals which are produced by the solid state photosensing devices in response to the two switchable levels of drive potentials.

3 The image sensor as set forth in Claim 1, wherein the amplifying means has a linear input-output relation.

4. The image sensor as set forth in Claim 2, wherein the amplifying means has a non-linear input-output relation.

5. The image sensor as set forth in Claim 1, wherein the amplifying means produces the electric signal in digital format.

6. The image sensor as set forth in Claim 1, further comprising storing means for storing reset signals produced by each of the solid state photosensing devices, wherein the amplifying means changes the variable gain according to the stored reset signals.

7. The image sensor as set forth in Claim 1, wherein the solid state photosensing devices produce the electric signals in a non-linear relation with respect to quantity of incident light.

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